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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/642,371	08/15/2003	Yong Chen	100110197-1	2549

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EXAMINER	
DANIELS, MATTHEW J	
ART UNIT	PAPER NUMBER
1732	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	02/21/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/642,371	CHEN ET AL.	
	Examiner	Art Unit	
	Matthew J. Daniels	1732	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 November 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13,15-18 and 34-48* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-13,15-18 and 34-48* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. Rejections set forth previously under this section are withdrawn in view of the amended claims.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claim rejections set forth previously under this section are withdrawn in view of the amended claims.

3. **Claims 34-37, 39-44, 46 and 47** are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Sasahara (US 2002/0012825). Applicant defines "nanoscale" on page 1, paragraph [0003] of the specification. **As to Claim 34,** Sasahara teaches a method of making nanoscale catalyst patterns comprising:

i) providing a malleable membrane having a top surface (Paragraphs [0038], [0039], and [0049]);

iii) forming one or more nanoscale recesses in the membrane (Fig. 8, item 126 or Figs. 3B and 4B, Par. [0039]), each recess having a bottom and side walls between the top surface of the

membrane and the bottom of the recess (See Figs. 3B and 4B, Par. [0039], and embossing in Par. [0052], or, the peaks, valleys, and sidewalls of item(s) 126 in Fig. 8); and

iv) depositing a layer of catalytic material on the top surface of the membrane and the bottom of the recesses (Par. [0057]).

Sasahara does not explicitly teach a mold having nanoscale protrusions and pressing the protrusions into the membrane. However, Sasahara teaches embossing (Par. [0021]) to produce impressed features having nanoscale dimensions (Par. [0019] and Figs. 3B and 4B or item 126 in Fig. 8), and it would have been inherent that a mold having nanoscale protrusions was used because the embossed surface would substantially replicate the size of the embossments used. In the alternative, it would have been obviously desirable to vary the size of the protrusions in view of Sasahara's teaching to vary the imprint size (Par. [0019]).

As to Claims 35-37, Sasahara teaches a membrane that is an ion conductive polymer electrolyte membrane of perfluorosulfonic acid polymer (commercially known as Nafion (DuPont), which is inherently ion conducting and comprised of perfluorosulfonic acid polymer, Par. [0038]). **As to Claim 39**, Sasahara clearly teaches the claimed height and lateral dimensions (Pars. [0019] and [0049]) for the larger features or inherent teaching about the size of the mold that produces those features. Use of protrusions having sizes of 5-10 microns would have been inherent or obvious in order to create impressions having that size (Par. [0019]). The Examiner's position is that the teaching of Sasahara contains sufficient specificity to anticipate the claimed size, but in the alternative, the claimed size would have been prima facie obvious as it comprises approximately 20% of the range of Sasahara. **As to Claim 40**, the Examiner interprets the shape of the protrusions of Sasahara to fall within the scope of a "pillar". However, in the alternative,

Sasahara suggests that the particular pattern and shape should be varied according to the purpose (Par. [0039] and [0043]). **As to Claims 41 and 42**, Sasahara does not explicitly teach the nanoscale protrusions having a regular pattern or that the resulting pattern has an obverse shape of the protrusions. However, Sasahar clearly teaches that the resulting impressions have a regular pattern, the embossed imprints would inherently replicate the shape of the protrusions used to create them (Pars. [0039]-[0043]). **As to Claim 43**, when the features in Figs. 2, 3B and 4B are interpreted as the features or recesses, the bottom of the recesses are parallel or substantially parallel to the top surface of the membrane, and the side walls are perpendicular to the bottom of the recess and the surface of the membrane (Figs. 2, 3B, 4B). **As to Claim 44**, Sasahara teaches a depth within the claimed range (Pars. [0019], [0039], and [0049]). **As to Claim 46**, the electrode of Sasahara (Item 34 in Fig. 2), placed into contact with the catalyst surface (Item 38 in Fig. 2) would cause the catalytic material to also act as an electrode. **As to Claim 47**, see platinum (Par. [0030]).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. **Claims 1-13, and 15-18** are rejected under 35 U.S.C. 103(a) as being unpatentable over Sasahara (US 2002/0012825) in view of Chou (USPN 5772905). **As to Claim 1**, Sasahara provides an article which could be used as an ion exchange membrane, the method comprising:

i) providing a malleable membrane that could be used as an ion exchange membrane having a top surface (Paragraphs [0038], [0039], and [0049]);

iii) forming one or more nanoscale recesses in the membrane ([0049]); and

iv) depositing a layer of catalytic material on the membrane (Par. [0057]).

In this rejection, Sasahara provides a nanoscale pattern shown as item 126 in Fig. 8. However, Sasahara is silent to providing a mold having one or more nanoscale protrusions, pressing into the membrane to form recesses having a lateral dimension ranging from 1 nm to 100 nm, each recess having a top surface, a bottom surface, and sidewalls.

However, Sasahara teaches emobossing (Par. [0021]) to produce impressed features (Par. [0019]), and an additional pattern provided with a length scale (B in Fig. 8) that is "clearly different" ([0049]) from the larger features (A in Fig. 8). Chou teaches a mold having one or more nanoscale protrusions (Fig. 1A, item 16 and Fig. 2), pressing into a membrane to form recesses having a lateral dimension of 25 nm (Fig. 1C and Fig. 2), which would implicitly have a top surface, bottom surface, and sidewalls (Fig. 1C). In the combined method, Sasahara teaches depositing platinum, which would reach the top surface of the membrane (the high points of 126 in Fig. 8) and the recesses (between the high points in the roughness of 126).

It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Chou into that of Sasahara because Sasahara clearly suggests embossing ([0021]), fabrication with known micromachining techniques which would provide the advantages of fine resolution and high repeatability (Par. 0050]), and that the second pattern (126 in Fig. 8) may have a prescribed pattern ([0049]). Chou provides a known

micromachining technique having fine resolution and high repeatability, and the ability to provide a prescribed additional pattern which could be varied to achieve any desirable roughness

As to Claims 2-5, Sasahara teaches a membrane that is an ion conductive polymer electrolyte membrane of perfluorosulfonic acid polymer (commercially known as Nafion (DuPont), which is inherently ion conducting and comprised of perfluorosulfonic acid polymer, Par. [0038]). **As to Claim 6**, Chou teaches a mold comprising a substrate and a molding layer including an array of protruding features having nanoscale dimensions (Fig. 1A, Items 12 and 14). **As to Claims 7 and 8,** Chou provides nanoscale protrusions having a lateral dimension of about 25 nm (Fig. 2) and a height of about 100 nm (3:40). **As to Claim 9**, Chou provides a pillar shape (Figs. 1-2). **As to Claims 10-13**, Chou provides a regular pattern where the recesses have the obverse shape of the protrusions, the bottom of the recesses being parallel to the top surface, and the sidewalls are perpendicular to the bottom of the recesses and top surface of the membrane (Figs. 1-2). **As to Claim 15**, Chou teaches that in depositing material on an embossed surface, it is conventional for the sidewalls to be substantially free of catalytic material (Fig. 5A). **As to Claim 16**, the electrode of Sasahara (Item 34 in Fig. 2), placed into contact with the catalyst surface (Item 38 in Fig. 2) would cause the catalytic material to also act as an electrode. **As to Claims 17 and 18**, see platinum (Par. [0030]).

5. **Claims 38, 40, 45 and 48** are rejected under 35 U.S.C. 103(a) as being unpatentable over Sasahara (US 2002/0012825) in view of Chou (USPN 5772905). Sasahara teaches the subject matter of Claim 34 above under 35 USC 102(b), or in the alternative, under 35 USC 103(a). **As to Claim 38**, Sasahara is silent to the claimed substrate and molding layer. However, Chou

teaches a mold comprising a substrate and a molding layer including an array of protruding features having nanoscale dimensions (Fig. 1A, Items 12 and 14).

It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Chou into that of Sasahara because Sasahara clearly suggests embossing ([0021]), fabrication with known micromachining techniques which would provide the advantages of fine resolution and high repeatability (Par. 0050]), and that the second pattern (126 in Fig. 8) may have a prescribed pattern ([0049]). Chou provides a known micromachining technique having fine resolution and high repeatability, and the ability to provide a prescribed additional pattern which could be varied to achieve any desirable roughness.

As to Claim 40, in the event that Sasahara's features cannot be interpreted to be "pillars", Chou additionally teaches pillars (3:38). It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Chou into that of Sasahara because Sasahara clearly suggests selecting or varying the imprints (Par. [0039]). **As to Claim 45**, Sasahara is silent to the sidewalls remaining free of catalytic material. However, Sasahara clearly suggests depositing catalytic material (Pars. [0006] and [0037]). Chou teaches that in depositing material on an embossed surface, it is conventional for the sidewalls to be substantially free of catalytic material (Fig. 5A). **As to Claim 48**, Chou teaches a lateral dimension of about 25 nm (Fig. 2), and Sasahara suggests that the length scales of the two types of surface features are "clearly different" ([0049]).

Response to Arguments

6. Applicant's arguments filed 14 November 2006 have been fully considered but they are not persuasive. The arguments appear to be on the following grounds:

a) Applicants have amended Claim 1 to define a lateral dimension ranging from about 1 nm to about 100 nm. Sasahara teaches only 5 microns to 500 microns and Applicants' range excludes the relatively large dimensions taught by Sasahara. Sasahara teaches "mesoscale" features, but does not teach or suggests nanoscale features.

b) As to the alternative rejections under 35 USC 103(a), Sasahara would not have found a reason or purpose for reducing the size to the nanometer range.

c) The combination with Chou would render a method of forming mesoscale features using a nanoimprinting method as suggested by Chou.

7. These arguments are not persuasive for the following reasons:

a) The amendment is noted. However, for those claims which are drawn to a length scale of 1 nm to 100 nm, it is asserted that Sasahara provides an additional degree of surface roughness (126 in Fig. 8) which has an average length scale B which is "clearly different" from the length scale of the mesoscale protrusions A ([0049]). From Fig. 8, it can be seen that Sasahara suggests that the length scale B is clearly *smaller*, and it is additionally suggested in [0049] that this roughness be provided with a prescribed pattern. Chou provides a prescribed pattern by embossing, as suggested by Sasahara, which would be suitable for providing the features denoted as 126 in Fig. 8.

It should also be noted that the new and amended claims and remarks appear to distinguish the claimed invention only by the size of the imprints. However, it is unclear that the size of the imprints or protrusions alone is sufficient to distinguish the claimed *method*, which provides substantially the same process steps.

b) Sasahara already provides a second surface feature which has a size which is "clearly different" than the mesoscale embossments.

c) Sasahara suggests embossing to produce two surface features having clearly different sizes and prescribed patterns ([0049], for example). In view of this teaching, it is asserted that the incorporation of the mold and/or method of Chou into that of Sasahara is proper. Sasahara provides both mesoscale features and features having a clearly smaller size.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Wrighton (USPN 4936956) is cited for teaching that it is conventional or inherent that sputtering of platinum deposits material substantially only on the surface of a film or the base of a trench in the film (Fig. 2, see "Metal (Au or Pt)").

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Daniels whose telephone number is (571) 272-2450. The examiner can normally be reached on Monday - Friday, 8:00 am - 4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christina Johnson can be reached on (571) 272-1176. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MJD 2/15/07

CHRISTINA JOHNSON
SUPERVISORY PATENT EXAMINER
2/15/07